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Worldwide Report

ENVIRONMENTAL QUALITY

(FOUO 3/80)

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CONTENTS

BRIEFS

EEC AID FOR UGANDA --During March, the European Economic Community (EEC) granted additional special aid of 300,000 ECU's [European currency units] (1 ECU--5.9 French francs) to Uganda to permit it to face the drought which is affecting the northern and eastern parts of the country. The EEC is also supplying food and has sent 700 tons of powdered milk and 222 tons of corn flour. [Excerpts] [Paris MARCHES TROPICAUX ET MEDITERRANEENS in French 28 Mar 80 p 758].

CSO: 5000

JAPAN

MAKERS NONPLUSED OVER DETERGENT ISSUE

Tokyo THE MAINICHI DAILY NEWS in English 11 Mar 80 p 12

[Text]

Soap and detergent makers in Japan are trying to decide how much emphasis they should place on the production and sales of detergents that do not contain phosphate.

The Kao Soap Co., Japan's top manufacturer of synthetic detergents, announced recently that it will start selling nonphosphate detergents in Shiga Prefecture and nearby areas beginning in the middle of this month, and the Lion Fat and Oil Co. is preparing to market the same kind of nonphosphate detergents.

Admittedly, the step was prompted by an ordinance enacted by Shiga Prefecture banning the sale, use and even gifts of synthetic detergents, called "legislation concerning the prevention of eutrophication of Lake Biwa," which is to take effect on July 1.

The Kao Soap Co., which is bringing out a nonphosphate cleaning agent named "Just Powder," does not deny that it has been perplexed by the questions of the manufacturing scale and prices of the new products.

Campaigns to banish synthetic detergents containing phosphate have been launched in many parts of the country, and manufacturers expect brisk sales of the substitutes.

More Expensive

However, one drawback is that new detergents have less washing power than the conventional ones and thus will cost some 10 percent more, from a standpoint of efficiency.

Thus, the makers wonder whether consumers will buy the substitutes just to protect the environment.

Osaka, Hyogo, Nagano and Ibaraki prefectures and cities such as Kashiwa City, Chiba Prefecture, Hachioji City and Machida City, both in Tokyo, and Yasugi City, Shimane Prefecture, have joined in the move to ban the use of synthetic detergents in the cause of environmental protection. To start off, they have begun to use powdered nonphosphate soap in their offices and schools, and are advising citizens to make the switch.

It is expected that several makers will have nonphosphate detergents on the market by summer, but in relatively small amounts. Needless to say, they do not want to be caught with excessive inventories if the public's reception is unfavorable.

The Japan Soap and Detergent Association, in its efforts to block the Shiga

Prefectural ordinance, once claimed that a ban on the use and sale of synthetic detergents was not justified without sufficient scientific proof of their harmfulness.

Now, however, the association is ready to observe the restriction, at least in and near Shiga Prefecture and in some areas of Nagano Prefecture. A spokesman for the Kao Soap Co. said that the industry had not expected such a widespread movement against synthetic detergents.

Incidentally, representatives of the Kao Soap Co. recently visited the Shiga prefectural office and said that the company would shelve its plan to bring a case to court "to defend the freedom to engage in business, which is guaranteed by the Constitution."

Lawsuit Unlikely

They said that they had not given up the idea of instituting a lawsuit, but that they would like to see how the citizens of Shiga Prefecture react to the legislation after it is enforced.

It is not likely, however, that the Kao Soap Co., or any other synthetic detergent manufacturer or even the Japan Soap and Detergent Association will initiate court action against the prefecture in the future.

In the meantime, Hiroshi Kabayashi, board chairman of the Lion Fat and Oil Co., said, "We wonder if the comparatively expensive nonphosphate detergents will sell well in Tokyo and other major cities, even though campaigns against synthetic detergents are said to have been effective."

"Of course," he went on. "we couldn't ignore the opposition voiced by people who are concerned about environmental problems. We will decide when to begin selling the new detergents and how much of them we will produce after we see the consumer response and get a consensus of the public."

In conclusion, the leading detergent makers are ready to produce nonphosphate detergents, but they hesitate to engage in mass production of them.

Accordingly, it is expected that nonphosphate detergents and conventional synthetic detergents will be sold side by side in almost all the prefectures.

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INTER-AFRICAN AFFAIRS

CYCLONE PROTECTION SYSTEM ADVOCATED

Paris AFRIQUE-ASIE in French 18 Feb 80 pp 44-45

[Article by Elie Ramaro]

[Text] It would undoubtedly be more humane and more economical to protect the people and their surroundings against cyclones rather than to "repair" the damages caused by them.

"A thousand times more powerful than an atom bomb. Ten or fifteen Hiroshima's per second. A gigantic suction pump." This is a tropical cyclone when it reaches full force. These cataclysms are called "typhoons" in Asia, "hurricanes" along the American seacoasts, "baguios" in the Philippines, "willy-willies" in Australia, and simply "cyclones" in Madagascar, in Mozambique, and on the islands of Mauritius and Reunion. In these countries, every warm season (which is the same as the rainy season) is also the "cyclone season,"which is awaited with a certain amount of anxiety.

The phenomenon is beginning to be easily recognized. Whirlpools constantly appear in the ocean, with winds of 40-60 km/h, but they generally die out of themselves. The situation is entirely different when they encounter a warm sea and a warm current which produce very humid air; the interaction between the air and the water, the action of condensation and evaporation can produce a tremendous force: winds which blow from 120-200 km/hour and waves which are several meters high, all ranging over an area of several hundred square kilometers in a perfect circle. The space at the center of this circle is completely calm and the sky is clear: "the eye of the cyclone."

The enormous eddy sweeps from east to west over an area which may be from 24 to 800 km wide. Its devastating force is much greater if it is moving at a very slow speed: 25 to 30 km/hour. However, when the cyclone reaches land, it becomes "exhausted" and loses its vigor. When it moves over cold waters, it gradually dies out.

But before dying out, David and Frederick in the Antilles, or Claudette and Hyacinthe in the Indian Ocean can do terrible damage when the day pass over populated areas, especially islands (which they pass over too quickly to really lose any of their fury). Last September in the Caribbean Sea, it was David: 1,500 people were washed away, crushed, electrocuted or drowned in the little state of Dominica: many others perished in Florida where the cyclone wore itself out. Frederick attacked Guadeloupe and Saint Martin -- where the banana plantations were completely destroyed -- and then,Puerto Rico. After the "monster" passes, the same spectacle is seen everywhere: crops destroyed, electric and telephone networks cut, roads torn up, dwellings blown away, trees blown down or stripped of their foliage, fishing boats and shipping smashed, and embankments and ports damaged. In poor countries, where the economy is precarious, this can be a real catastrophe.

250,000 Deaths in 1970

Claudette passed over the island of Mauritius during the night of 22-23 December. At least 40 people were left dead, more than 100 houses were destroyed, there was flooding, and the main part of the electric and telephone installations had to be entirely rebuilt. During the latter half of January, Hyacinthe went back and forth between Reunion (100 dead, the island ravaged) and Madagascar (where the province of Tamatave sustained a great deal of damage).

The WHO, which has studied the consequences of these phenomena, estimates that there have been 800,000 victims since 1950. The most destructive cyclone laid waste to Bangladesh in 1970, causing floods which caused the deaths of 250,000 people. Since then,in that country, which is one of the poorest in the world, the peasants have built mounds of earth behind which men and animals can seek shelter in case of another disastrous storm. Texas, which is very wealthy, has built a wall 20 km long and several meters high to keep the Galveston area from being submerged. Six thousand people drowned there in 1900.

Orsec 1,2; Alerts A, B, 2A, 2B

Most of the countries involved have set up systems to alert the public. For instance in the French Antilles, when David and Frederick arrived, they had been preparing for the "shock" for 5 days and 5 nights: launching Orsec plans 1, then 2, and Alerts A, B, then 2A and 2B. Transistor radios stepped up the warnings: "In cases where the house is not attached to the ground [as is the case in most working-class houses], arrange heavy objects on the floor to increase adherence; if the house is built of stone or concrete, nail shut the doors and windows, evacuate areas near waterways or river banks; stock up on food." Then came the orders: "Find shelter immediately... Do not stay near windows...Keep listening, etc."

In the United States, where there is a hurricane center responsible for controlling cyclones, for several years, technicians have been trying to

grapple with the actual cause of the phenomenon, hoping to nip threatening depressions in the bud by injecting them with silver iodide crystals. However, the project, named Stormfury, had to be abandoned for lack of satisfactory results.

This leaves forecasting, which has made tremendous progress during the last ten years, mostly through data furnished by the weather satellites. Five of them, placed in orbit above the equator by the United States in 1978, continuously monitor the formation and then the path of cyclones. One of them -- "Tiros" -- monitors the Indian Ocean. The photographs which it takes arrive at the meteorological centers in Antananarivo (Madagascar), Saint-Denis (Reunion) and Vacoas (the island of Mauritius) every day. The total amount of data for the entire region is then defined in more detail, zone by zone, and country by country, by radars with a range of 200-500 km, and by traditional meteorological methods which are carried out, in particular --for the southern part of the Indian Ocean--on isolated islands, such as Saint Brandon, Rodrigues Island, Tromelin, Europa, etc.

Similar systems are also being installed in Southeast Asia, where India, Ceylon, Pakistan, Bangladesh and Cambodia are working on a common project of "Cyclone Preparedness"(surveillance and alarm devices). At the same time, the WMO is coordinating world-wide studies on the atmosphere within the scope of the international meteorological program. For example, conditions for formation of the Indian monsoon should be better understood thanks to operation "Balsamine", recently launched in the Indian Ocean with the release of 100 meteorological balloons from Diego Suarez (Madagascar) and Mahe (Seychelles), and twice-daily plotting of their position through the "Argos" system.

A tropical cyclones committee from the southwest region of the Indian Ocean meets regularly. During its last meeting, in October, at Maputo (Mozambique), it adopted a coordinated plan of action for various weather services in the countries in the region. Upon that occasion, Mr Malick, head of Reunion's weather bureau complained that the island does not have adequate equipment for direct reception of data sent by geostationary satellites, and must be content with very incomplete data. For direct reception, a primary space receiving station would have to be constructed, and that would be very costly.

Periodically, the newspapers in Reunion become anxious about the weakness of Reunion's installations for protection against cyclones. TEMOIGNACES, organ of the local Communist party, compared the sums of money devoted to these installations to the amount spent on maintaining 3,000 soldiers in Reunion, some of whom (the 1,200 men of the RPIMA [Naval Infantry Paratrooper Regiment] and the 300 employees of air base 181) are involved in interventions in neighboring countries. "Wouldn't it be more significant to build a weather station which would peacefully help to protect our neighbors from cyclones? the newspaper asked.

Appeals from Debre

Furthermore, many people observed that since the island had not had a severe cyclone since 1949, there was a strong probability that it would soon experience one. Hyacinthe tragically confirmed those words. And Michel Debre, who launched pathetic appeals for "national solidarity," would have been better advised to use his influence to make people listen before and not after the cyclone.

The population of Reunion has doubled in thirty years, but no preventive measures have been taken: urbanization, construction, public works -- directed by Europeans who are used to temperate zones and often do not understand local realities -- have not adequately considered the risks involved. Examples have been cited: the Leconte-de-Lisle secondary school (built right in the middle of the Butor ravine), a government low-cost housing development (built between two ravines, at Deux-Canons), bridges with aprons which are too low, etc.

The same people were worried about the fate which would be reserved for inhabitants of shantytowns in case of a cyclone. They are the first to be threatened by hurricanes which can destroy houses constructed of stone or concrete. And out of a total of 105,000 houses, 60,000 dwellings in Reunion were acknowledged to be "unhealthful." This means that they were flimsy. The experts called to mind another danger: in 30 years of "departmentalization" this mountainous island has been systematically deforested, cleared of stones, and strewn with invasive structure, and the waters and the land were no longer held back as they were in the past. Erosion has caused devastation. Didn't the torrents of water dumped by Hyacinthe, rushing into the "wild" ravines, carry off part of the best land on the island? And forever.

Hyacinthe at Reunion

The passage of cyclone Hyacinthe dealt a blow to the most valuable sector of Reunion's economy, her agriculture, which employs nearly a third of the working population.

Sugar cane, of which the growing season has just ended, could sustain a drop in production of hitherto unknown proportions in 1980. Furthermore, new methods used for this crop are responsible for the extent of the damages sustained by the island. Specific crops--geranium, cuscus, vanilla, tobacco, early produce--were destroyed, sometimes entirely, which means to loss of income for thousands of families living in regions where any other activity, even agricultural, is inconceivable. Planting of such crops is, indeed, very difficult, and the selection of plots and types of plants is the fruit of long study which cannot be done in a short period of time.

On the other hand, the construction and public works sectors should temporarily recover somewhat by repairing the roads, other infrastructures

and dwellings. But the effort in favor of socialized housing to avoid the reappearance of shanty-towns, so easily destroyed by cyclones, will be strictly limited to the short term.

In any case, refinancing of work for the unemployed for 10 million francs--since the commons entrusted to the unemployed the development of public housing, with the political manipulations which that entails--and aid to farmers who were victims of the disaster, will thrust Reunion a little further into social welfare, that evil which claims as its victims many Third World peoples.

From Albine to Zoe

In the southwestern part of the Indian Ocean, alphabetical lists of future cyclonic disturbances are drawn up every year before the beginning of the season. In this region--no one knows why--cyclones are always given feminine names. In 1979-1980, Albine, Berenice, Claudette, Danitza, Eglantine, Flore, Gudule, Hyacinthe, Ivanne, Jacinthe, Kolia, Laure, Micheline, Nanou, Odile, Patsy, etc. Why so many Christian names, and so few Bantu, Swahili, Malagasy or Indian names?

Hyacinthe at Madagascar

The international press reported widely on the damages done by cyclone Hyacinthe to the island of Reunion. But it has remained silent on other ravages caused in this area of the Indian Ocean.

In the course of its turbulent meanderings, Hyacinthe made several forays between Reunion and the east coast of Madagascar. This was especially true of Tamatave faritany, the most endangered area, which sustained heavy property damage. The valuable clove tree plantations--which produce only every two years--were hard hit. The Malagasy Government must mobilize sizeable resources if it is to assure relief.

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USSR

ECONOMIC INDICATORS FOR ECOLOGICAL MEASURES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 2, Feb 80 pp 46-52

[Article by Academician T. S. Khachaturov: "Economic Questions of Ecology"]

[Text] It is generally recognized that a rise in production can cause harm to the atmosphere, to the water resources, the earth and its minerals, to the forests and the landscape. Over the last 25 years, world industrial product has increased by 5-fold, while in the socialist nations it has increased by 12-fold and by more than 3-fold in the developed capitalist countries. With such high growth rates for production, the strain on the natural environment is correspondingly aggravated. A sense of ever greater urgency is being assumed by the problems which are brought about, on the one hand, by the growing process of the depletion of the resources utilized by man, and, on the other, by environmental pollution.

Scientific and technical progress opens up the way to offsetting the nature-damaging consequences of human production activities. Opportunities also arise for the more economic utilization of natural resources, and for sharply reducing and then completely eliminating pollution. But the use of these opportunities requires significant outlays. For this reason, an important task of the economics of ecology is to bring out the economic aspect of ecological measures, to determine the amount of expenditures for carrying out the measures and to compare the latter with the effect obtained. The socialist economic system and public ownership of the means of production and the natural resources make it completely feasible to have the planned, thrifty and integrated use of natural resources considering the development of society over the long run.

The following data show the increase in the production volume and the greater demand for raw materials in the USSR. In 1951-1978, our national income increased by 7.4-fold (7.7 percent annually), while industrial product rose by 10.5-fold (9.1 percent annually). The population grew by 43 percent, and gross agricultural product rose by 179 percent. Over this same period, for example, coal output rose by 3-fold, oil output by 15-fold, natural gas by 58-fold, iron ore by 6-fold, cement production by 12.5-fold, and mineral fertilizers by 20-fold.

In the overall value of gross industrial product, the proportional amount of the extracting industry is slight, comprising all of about 8 percent; here the share of the mining industry is just 5.5 percent. Such a low proportional amount in terms of value is explained by the relative cheapness of the raw materials. But for other important economic indicators, the proportional amount of the extracting industry is much higher: around 15 percent for the number of workers employed, and 25 percent in terms of the value of the fixed capital.

The absolute volumes of raw materials output are very significant. Each year around 6 billion tons of various raw materials (not counting the barren rock) are mined. By the end of the century, under the condition of the ever more careful attitude toward the raw materials being mined, each year we must produce at least 10-11 billion tons. This will mean that during the period up to the year 2000, up to 170-180 billion tons of raw materials will be produced, not counting the rock, in maintaining the existing growth rates of industry. But if these rates accelerate, the demand for raw materials will further increase. And correspondingly the production wastes will be increased and reach very large amounts. It is essential to bear in mind that in producing individual mass types of products, the waste products released into the environment comprise 8-12 percent more (not counting the mining wastes) of the processing volume.

The Soviet Union is rich in natural resources. We have more than one-half the world's proven and probable coal supplies, two-fifths of the iron ore reserves, four-fifths of the manganese ore reserves, and significant reserves of oil, nonferrous metal ores and potassium salts. Our nation abounds in supplies of fresh water, there are vast areas of fertile land, and enormous forest wealth. But in the USSR as well, certain known deposits and other sources of raw materials are being worked out or have already been depleted, and this is reflected in the economic indicators of the sectors which mine or process the corresponding types of raw products and fuel. As a result of the depletion of a number of rich and conveniently located deposits, it is essential to utilize raw materials of inferior quality and with a lower mineral content, and transport this over great distances. And both factors lead to a rise in the cost of the end product. In this regard a study of the underground resources and other sources of raw materials becomes particularly important.

During the years of Soviet power, a large number of very rich mineral deposits has been discovered. But there still are many opportunities for geological discoveries in the little-studied regions of the nation, in the bowels of the earth, on the shelves and on the floor of the seas and oceans, aside from the fact that with scientific and technical progress completely new opportunities are opened up for utilizing already known materials, as was the case at one time with petroleum, uranium and titanium, and as obviously will be subsequently with hydrogen (used as a fuel).

In evaluating the expenditures needed to locate and employ the new resources of raw products and materials in production, it is also essential to

consider the expenditures on preventing pollution of the environment (the air, water or soil), as well as preventing a rise in the average water and air temperature (the so-called thermal pollution).

Along with finding new natural resources, measures must be taken to make better use of the existing reserves of raw materials, starting with mining and ending with the obtaining of finished products. In many instances this will prove to be more economic than the prospecting for and mining of new quantities of raw materials. Economic calculations and comparisons are required for the expenditures, capital and current, required for the more complete and rational processing of the raw materials and waste products, as well as for increasing the mining of raw materials. In particular, it is essential to solve the following problems: A reduction in the losses of raw materials in mining, the comprehensive utilization of the extracted raw materials, a reduction in the consumption rate of the raw materials on the basis of more advanced production methods, the broader use of secondary raw materials and the changeover to waste-free production, and the replacing of scarce types of raw materials with nonscarce ones. The solving of these problems requires the carrying out of economic calculations.

For example, raw material losses can be reduced by employing more advanced extraction methods (perimeter and contour flooding of oil deposits and gas injection which increase the underground pressure; the utilization of surface-active substances; the introduction of geotechnology, that is, the underground dissolving of underground salts with the pumping of the solutions to the surface, the leaching of copper ores using bacteria in the solutions, and underground melting of sulfur). The realization of new production methods leads to capital investments and additional current expenditures which progressively increase the cost of each additional percent of raw materials extracted from the ground. In this instance the economic calculation consists in determining what is the marginal return of the deposits whereby the additional amount of raw materials should be extracted with the given price level for the raw materials, by comparing the additional expenditures with the expenditures on developing the new deposits and considering the necessity of saving resources and carrying out environmental conservation measures.

A reduction in the losses of raw materials depends largely upon the comprehensive use of the extracted raw material. This is a question of using all the side components mined simultaneously with the raw material, on the one hand, and the rational utilization of the refining products, on the other. For example, we must not only smelt copper from the mined copper pyrite and other copper ores, but also utilize all the other, often very valuable components from these ores, and not allow their loss in dumps or as volatile wastes such as the sulfur anhydride which is released into the air. At a number of the nonferrous metallurgical enterprises, the sulfur gases in ever greater amounts are being processed into sulfuric acid, and this simultaneously protects the surroundings of the copper smelting plants against their harmful effect. However, a large amount of sulfur gas still is not recovered and continues to be released into the atmosphere.

From the apatite-nepheline ores, up to the present either apatite is extracted for producing phosphorous fertilizers (the nepheline goes onto the dump) or only the nepheline is used to produce alumina. But it is perfectly possible and essential to utilize both the ore components simultaneously. The integrated use of the various components contained in the bulk raw material mined can provide a significant economic effect. Sometimes this effect becomes so great that the side product becomes the basic one. For example, this has happened in obtaining sodium sulfate and simultaneously hydrochloric acid as a result of the interaction of the sodium chloride and sulfuric acid in the sulfate furnaces, as well as in many other processes.

All of this shows the importance of a more purposeful and comprehensive planning of the extraction and processing of raw materials and the creation of a material incentive for its comprehensive utilization, as well as the conservation of the environment. However, there can be other instances when there is not a sufficient demand for one or another component either on the domestic market or abroad, and the capital investments and current expenditures required for extracting this component are not justified. A comparison of the possible economic effect and the expenditures for settling the question of utilizing one or another component is essential.

A great economic effect can be provided by a sound reduction in the consumption rates of raw products and materials as a consequence of employing more advanced production methods, better raw materials or higher quality processing of them. The wide use of metal cutting in machine building leads to significant metal losses. These losses could be reduced by improving production methods, by converting to precision casting, to electrophysical methods of metalworking, and to increasing the proportional amount of working pieces by pressure. This would necessitate an increase in the production of sheet. A reduction in the demand for metal can also be achieved by the more rational designing of machinery and equipment, by eliminating the surplus safety margin, by employing high-grade metal, by the strengthening of friction surfaces, and by the simultaneous painting or plating of surfaces with protective films, and so forth. All of this ultimately leads to a reduction in the demand for iron ore, for the casting of iron and steel, and hence, will save raw materials and restrict environmental pollution.

The consumption of wood can be significantly reduced in structural elements, and the life of wooden bridges and ties can be extended by saturating the wood with antiseptics and fireproofing compounds, and by painting it. This would mean a limitation on the demand for felling the forests and would help to preserve them. Crating must be also be more rationally utilized. The production of wooden crating requires around 65 million cubic meters of wood converted into logs, and a significant portion of this crating is used only once and then destroyed. The production of cardboard, polyethylene and other types of crating can provide a great savings in lumber. Calculations indicate that the capital investments required for this would be recovered within an acceptable time.

Improving the quality of fertilizer and bettering the methods of transporting it can provide a great effect. The measures to ensure the complete safekeeping of the crop and livestock products, their delivery, processing and storage without losses are essential and very effective. For this more elevators, warehouses, vegetable storage facilities and roads must be built.

A savings of materials can be achieved in all areas of their use and in all sectors of production and the nonproduction sphere. In a majority of instances, for achieving such a savings expenditures are required on introducing the new production methods, on developing processing, on improving transport, and on raising the quality of storage. But the effect consists in reducing the demand for the corresponding materials and raw products, and hence, for expenditures on their production and extraction, and consequently, in the expenditures on environmental protection. Calculations indicate that ordinarily the additional expenditures in this sphere are repaid within the shortest time.

An effective way for saving raw products and materials is to use the secondary raw materials and any sort of wastes. A significant portion of the demand for the basic materials for producing ferrous metals is covered by the collected scrap metal. With the amount of metal in use in the USSR equal to approximately 1 billion tons, and with a withdrawal of metal of 4 percent because of all types of ware per year, scrap resources are about 40 million tons annually. A portion of the scrap is collected, but a good deal is lost, not mentioning the great losses due to corrosion. It would also be possible to collect and recycle tens of millions of cubic meters of waste wood, to regenerate lubricating oils, and utilize water repeatedly. The development of technology makes it advisable to create waste-free production. And here the task of the economic calculation is to figure the assumed savings and compare this with the necessary expenditures.

Finally, an important path of economy is to replace scarce types of raw products and materials with nonscarce ones, for example, the replacing of nonferrous metals by plastics, natural leather by synthetic, and employing new types of finishing materials in construction. Certainly such a replacement is carried out not only when the savings of scarce materials is achieved, but also there is an economic effect, expenditures are reduced and environmental pollution is lowered.

For providing sound economic calculations to determine the savings from the rational utilization of raw products and materials, a value evaluation of natural resources is of important significance. Under the conditions of economic accountability, free natural resources with payment for all the means of production lead to a situation where the enterprises always prefer to save on the means of production in comparison with natural resources, for there is no economic incentive forcing a thrifty attitude toward them. The complexity of a value or cost evaluation of natural resources is explained by the fact that these resources should be valued not in terms of the labor invested in them as at the moment of the evaluation this labor may or may not have been made. At the same time, the evaluation should be

made for those natural resources the exploitation of which has not yet begun, and often the evaluation of precisely these resources is particularly important for their rational exploitation. This evaluation certainly is not aimed at the alienation of the natural resource, since under socialism it is public property and is not for sale. The evaluation is required merely to put the natural resource under economic accountability conditions in an equal status with the other reproduction conditions, and create a material incentive for the enterprises to show an economic attitude toward it.

The evaluation of the natural resource should be based upon that national economic effect which is obtained in employing this resource in production. Here the starting point for the calculation is the amount of differential rent which depends upon the quality of the resource, for example, the natural soil fertility and the location of the area to be valued, the content of the exploitable component in the raw material, and so forth. It is comparatively easy to value a natural resource which is renewable with its correct utilization, for example, soil the fertility of which is maintained by the application of fertilizers, by irrigation and by the rotating of the crops being grown.

Land is valued according to the expression $S = \frac{R}{E_n}$, where R--the differential rent obtained as an average over a number of years, and E_n--the efficiency norm used in the economic calculations. It is important to correctly determine the amount of R, not including in it the additional rent which can be obtained from the technical equipping and organization of production, and considering only that portion of income which depends upon the natural properties of the land and the climate. For this reason a land cadaster is required to precisely know the natural qualities of the area.

It is more complicated to value mineral deposits where mining is not evenly distributed over time. During the period of developing the deposit output rises, it remains more or less stable over the period the mining enterprise operates at full capacity, and then declines as the deposit is depleted. Proceeding from this, the value of a deposit can be calculated from the formula $P = R_a\left[\frac{(1+E_n)^t - 1}{E_n(1+E_n)^t}\right]$, where R_a--the average annual rent, t--the time of exploitation of the deposit.

Bearing in mind that rent changes over time, for totaling it over the years and deriving the average rent, it is essential to discount the rent and correct it in terms of the first year using the expression $\Sigma R_{cor} = \sum_{1}^{t} \frac{r_i}{(1+E_n)^i}$, where r_i--the actually obtained rent during year i. The average corrected rent will be $\frac{\Sigma R_{cor}}{t}$. This amount must be introduced into the formula for valuing the deposit.

The time has come to put the thus valued land, mineral deposits and other natural resources on the balance sheet of the enterprises extracting raw materials or producing agricultural products in order that these enterprises would pay to the budget deductions from the value of the resources; this measure should contribute to their fuller utilization. On the other hand, expenditures on preventing damage to the environment as a result of producing the given type of product should be included in the costs.

An important problem is to prevent the polluting of the air, the water and the soil and eliminating already produced pollution. The development of production and the rise of demand lead to the appearance and increase in the quantity of all sorts of wastes including gaseous, liquid, solid and those possessing a high temperature. The release of these waste products into the environment requires minimum expenditures for the enterprise, and for this reason is attractive for it but harmful for the environment.

Modern technology is capable of providing any degree of air purity by improving production methods or utilizing gas scrubbers. The same applies to water, to the land and to other types of natural resources. But in this instance expenditures on purification or the prevention of pollution will grow sharply. New natural conservation technology can necessitate an increase in capital investments and these must be compared with the change in current production expenditures and the benefits gained from utilizing the waste products and reducing environmental pollution. The use of purification facilities requires expenditures, and in individual instances these are very significant approaching 20-30 percent of the value of the enterprise fixed capital. But here a gain is also obtained. For example, from the recovered sulfurous gas, it is possible to produce cheap sulfuric acid. Sorted urban garbage can be employed both as fuel and as fertilizer. The expenditures related to the treatment or recovery of the waste products can be reduced by the amount of these gains. A conversion to low-waste and waste-free technology also requires additional expenditures.

Closely related to the designated problem are the questions of an economic evaluation of measures to combat the pollution of the air, water, soil and landscape for the purpose of protecting human health and for recreational purposes. The economy of ecology should consider the primary importance of preserving nature to improve working and recreational conditions, and hence, also for increasing labor productivity, the crucial factor in economic growth.

For determining the economic effectiveness of the measures to protect the environment, it is essential to calculate the amount of damage prevented by these measures. It is essential to determine all types of damage which can be caused to nature, if one does not intervene into the course of events, in a physical expression as well as in economic and value indicators, as well as the time during which the damage done to nature can be restored.

The assimilating capacity of the environment is limited, and waste products in amounts exceeding this capacity can cause lasting harm over many years. Here the time required for the recovery of the natural properties of the environment is extremely diverse. Thus, the required water purity in a river can be achieved in a comparatively short time after preventing the release of untreated wastes; but a much longer time running into years is required for replenishing the fish stocks in a river. And if one takes the replacement of a coniferous forest, here decades are required. The amount of the prevented damage should be determined for a number of years, in accord with the employed repayment dates for capital investments. The obtained amount $\sum_{i}^{t} Y$, where t--the repayment time, and Y--the annual damage, should be compared with the volume of capital investments and current expenditures required for the creation of the units and their operation K+Ct (K--capital investments, C--annual current expenditures) aimed at preventing damage from pollution.

The preservation of the purity of air and water and the protecting of the land and forests require great outlays and a strict observance of the laws aimed at allowing the USSR workers to make rational use of the natural riches of their country.

There is extensive literature on the questions of employing natural resources, and there are a number of prominent specialists in this area. But the economic questions of ecology as yet have been little worked out. Here is a very great field for diverse research. A method has been prepared for determining the effectiveness of expenditures on environmental conservation. The economists have a good deal to do both in the sphere of theory and in the area of practical economic calculations on the economics of ecology.

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